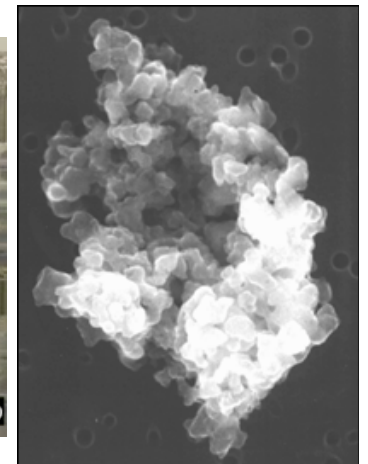




***“Dedicated to maximizing planetary sample science
while protecting the integrity of NASA-collected extraterrestrial materials”***

Community Comments for the Planetary Science Subcommittee

March, 2015
Hap McSween



CAPTEM

Curation and Analysis Planning Team for Extraterrestrial Materials

CAPTEM

*Chair: Hap McSween
(University of Tennessee)*

Lots of changes!

Lunar Sample
subcommittee

Chair: Alan Treiman
(LPI)

Stardust
subcommittee

Andrew Westphal
(UC Berkeley)

Genesis
subcommittee

Larry Nyquist
(JSC)

Cosmic Dust
subcommittee

George Flynn
(SUNY Plattsburgh)

Asteroid
Sample
subcommittee

Kevin McKeegan
(UCLA)

Facilities
subcommittee

Dimitri Papanastassiou
(JPL)

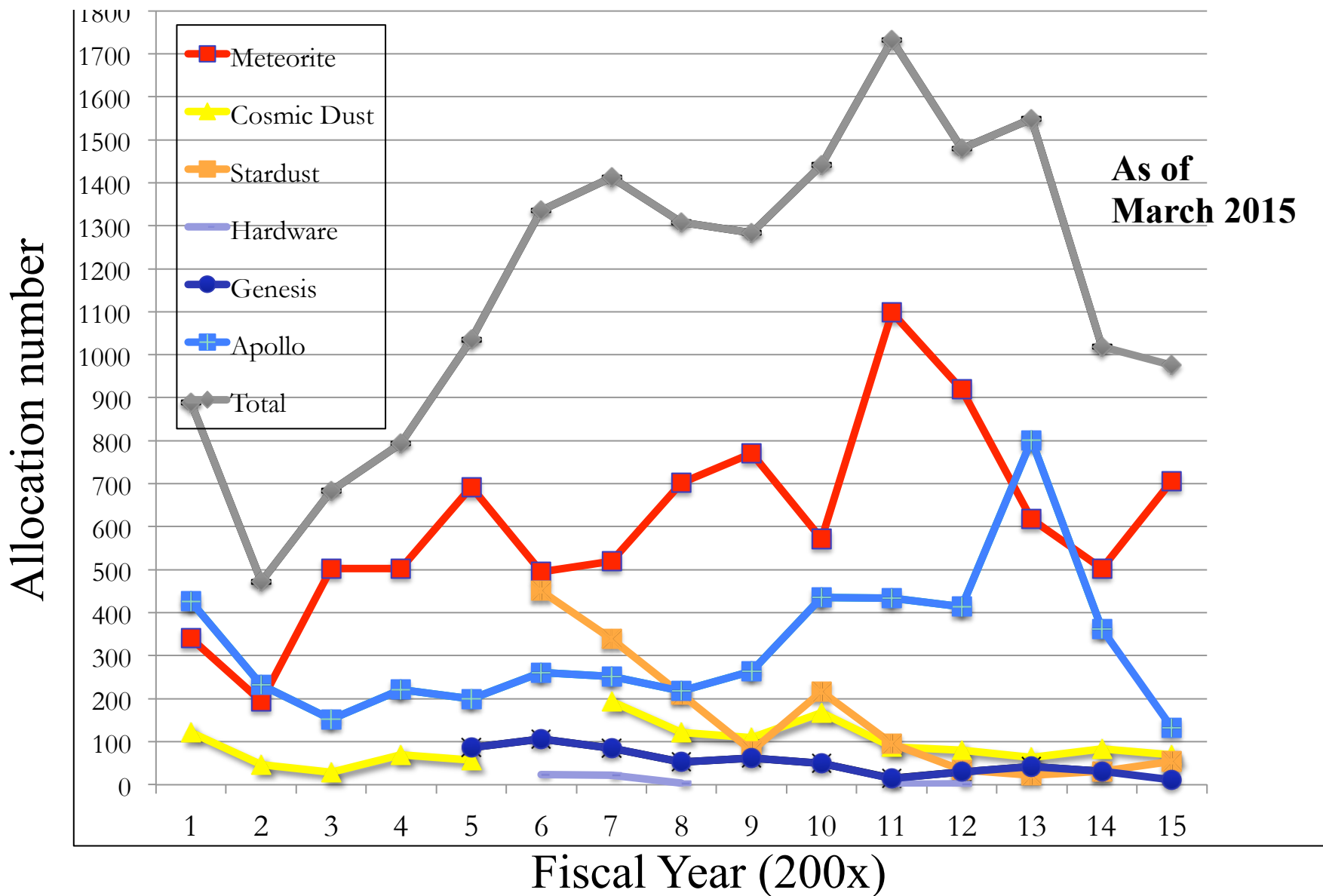
Meteorite
Working
Group

Conel Alexander
(Carnegie Inst)

Informatics
subcommittee

Andrew Westphal
(UC Berkeley)

Additional Members: James Day (UCSD), Juliane Gross (U Houston), Kieren Howard (CCNY), Rhianon Mayne (TCU), Jeff Taylor (U Hawaii), Aaron Burton (JSC, Secretary)



New Actions

- CAPTEM has assumed responsibility for findings on the curation and allocation of space-exposed hardware at JSC, including parts from: LDEF, Solar Max, EuReCa, Genesis, HST, Stardust, and Surveyor III
- CAPTEM has approved and delivered a report on Lunar Curation Cleanliness, requested by JSC Astromaterials
- CAPTEM will co-sponsor Stardust Workshop before the Meteoritical Society Meeting in Berkeley, CA this summer

Astromaterials Support for New Missions

OSIRIS RE_x

- Now archiving and documenting materials from the spacecraft, and cleaning and deploying witness plates for the construction phase
- Assembling requirements and scoping pre-construction costs for both the OSIRIS RE_x and Hayabusa 2 curation laboratories

Hayabusa 2

- Appointed a curator and coordinating with JAXA about curation

Mars 2020

- Hosted a workshop for Mars 2020 cache contamination control engineers and planetary protection
- Supported a review of planetary protection requirements and organic contamination experts

Asteroid Retrieval Mission

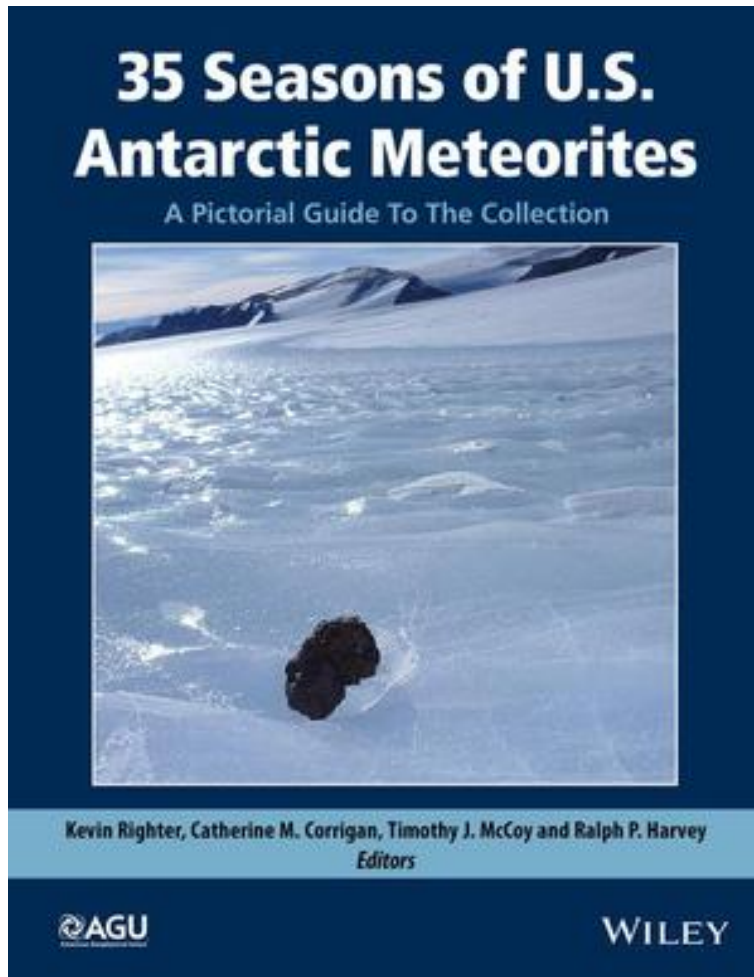
- Curation budget is included in budget planning cycle (through HEOMD)
- Participating in EVA tool working group

Astromaterials Outreach

- Educational sample disc and outreach programs have now reached thousands of students
- New social media sites featuring Astromaterials
 - Blog: myares.wordpress.com, Facebook (NASA ARES), Twitter, Instagram



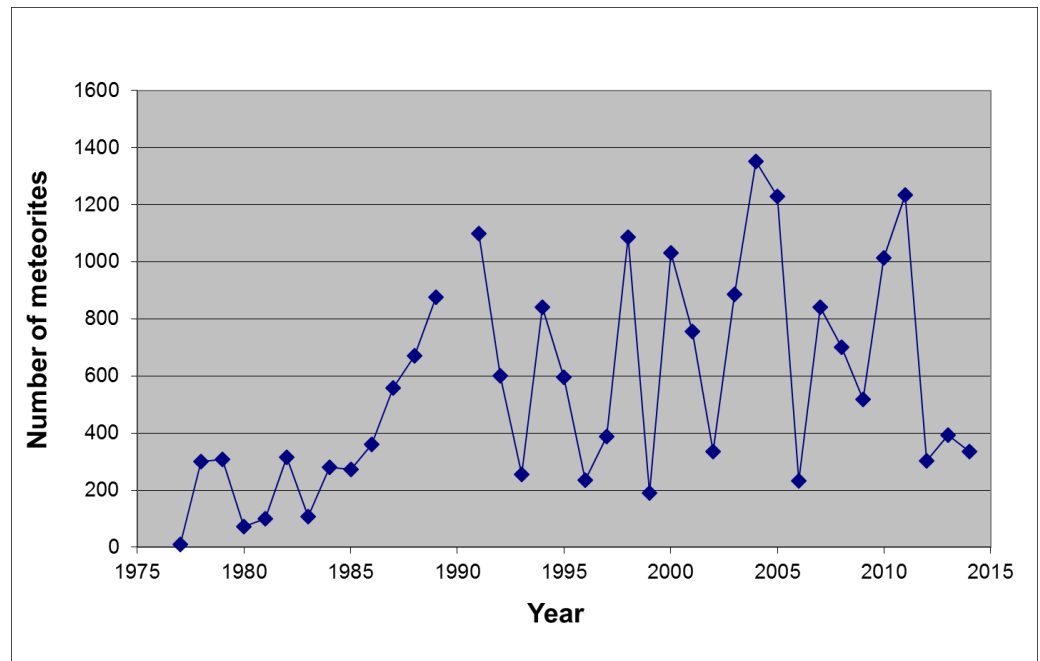
A Special Anniversary for ANSMET



This new book covers the history, field operations, curation, and statistical aspects of the collection, with feature articles on primitive chondrites, achondrites, lunar and martian meteorites, unusual meteorites, and cosmic-ray exposure histories.

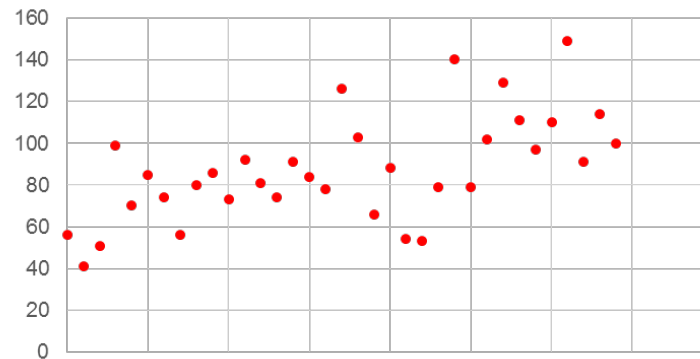
How big is the ANSMET collection?

- In the 37 US expeditions since 1977, **20,700** meteorites have been collected.
- As of Oct. 2014, **19,751** of these meteorites have been classified by the Smithsonian and are available to researchers worldwide.
- The ANSMET collection is the largest research collection of meteorites in the world, 2× bigger than any other, measured by the number of classified, available specimens.

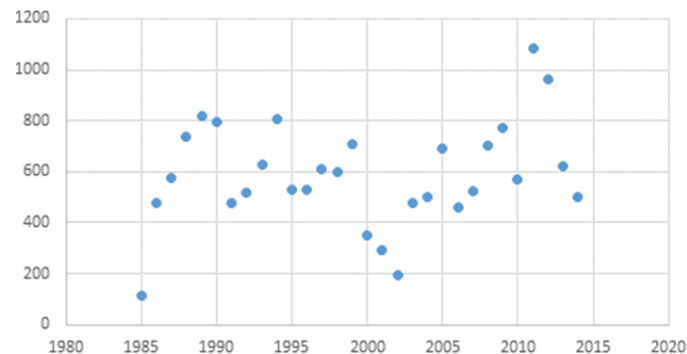


How much is the ANSMET collection used?

- Currently, around **100 proposals** for sample loans are received annually.
- Currently, around **700-800 specimens** (subsamples of meteorites) are prepared and loaned to investigators annually.
- All proposals receive peer review through the *Meteorite Working Group (MWG)*, except very routine requests, which receive curatorial review only.
- The three participating agencies, NSF, SI, and NASA, provide concurrence on all allocation decisions.






Proposals for sample loans reviewed each year



Individual specimens allocated by JSC Curation Facility each year

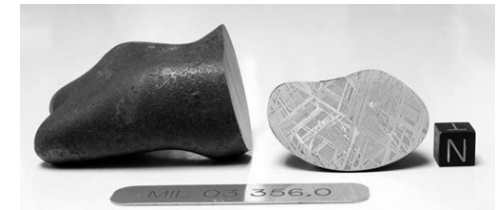
How many bodies in the Solar System are represented in the ANSMET collection?

- Most meteorites come from **asteroids**, but a few are pieces of the **Moon** and **Mars**. It is possible that some come from comets.
- The ANSMET collection contains 24 lunar and 15 Martian meteorites. 
- At least **80** “parent” asteroids are represented in the ANSMET collection (there are many fragments of each parent asteroid currently in space).
 - The majority of these are differentiated (melted) bodies. 
 - Several dozen are ancient, primitive bodies that preserve material from the birth of the Solar System (and before!). 

EETA79001



MIL 03356

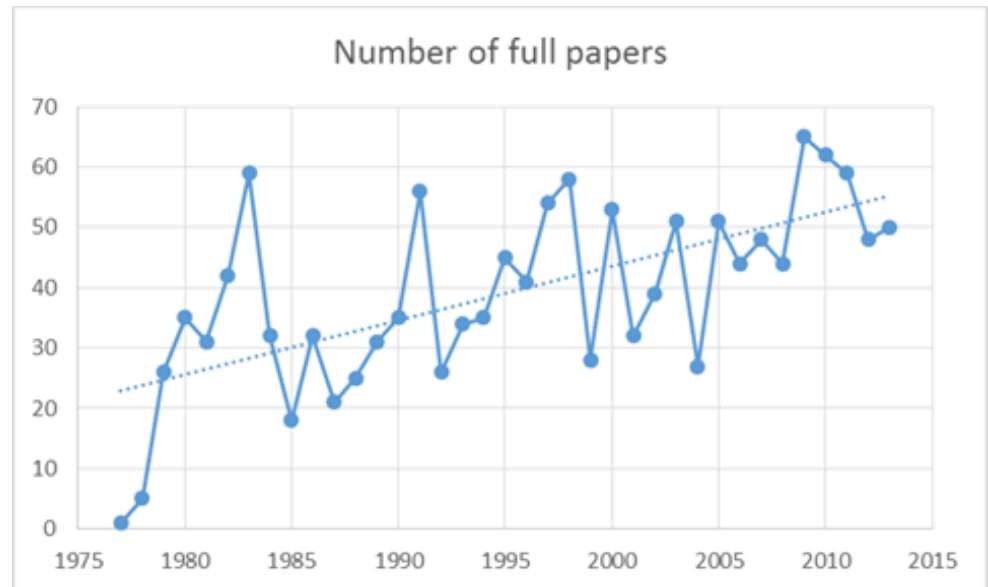


ALHA77307



How many scientific publications have been enabled by ANSMET?

- **>10,000** publications have resulted from research on ANSMET specimens, including papers, abstracts, books, dissertations, etc.
- The number of peer-reviewed papers published in major journals is currently **over 50 per year**, and is increasing with time.



What are the top discoveries resulting from ANSMET research?

- Some highlights:
 - Analysis of gases trapped in EETA79001 were used to prove that a group of **meteorites come from Mars**.
 - Research on ALH 84001 helped motivate NASA's current Mars **exploration** campaign, and advanced our understanding **astrobiology** and the history of **water** on Mars.
 - The discovery that some **meteorites come from the Moon** resulted from research on ALH 81005. This opened the discovery of other lunar meteorites, and greatly expanded the range of lunar samples for research compared to the Apollo collections.
 - Research on unusual ANSMET meteorites has greatly expanded the **number of asteroids available for study** and the range of processes known to have occurred.
 - Research on primitive meteorites found by ANSMET has led to significant advances in our understanding of **organic chemistry** in the Solar System, the role of **water** in the early Solar System, and the nature of **presolar dust** from which the Solar System formed.

Finding #1, regarding acquisition and preservation of extraterrestrial samples

- The Discovery and New Frontiers missions AO language stating that the mission plan “shall demonstrate that at least 75% of the returned samples shall be preserved for future studies” should apply to all sample return missions, robotic and human. Deviations from this policy must be convincingly justified.
- Each NASA institutional scientific collection should have a policy regarding long-term use and curation. The policy should consider the uniqueness of the samples, the expected timeline for loss of sample integrity, definition of whether the policy applies to the entire collection or to individual samples, how much sample should be conserved for future research or preserved for posterity, and a time period for review of the policy.

Finding #2, regarding the reorganization of R&A programs

- The SMD research program must be aligned so as to best achieve the NRC Decadal Survey goals. Astromaterials research constitutes a critical component of planetary exploration and answers fundamental questions that cannot be addressed by other means. After the first year of the reorganized R&A structure, it is apparent that solar system sample research has been negatively impacted. CAPTEM is concerned that diminishing astromaterials research capabilities will cause long-term harm to SMD's planetary exploration mission and erode U.S. leadership in extraterrestrial materials research.

Interstellar and Early Solar System Processes Identified in ~50 μm Extraterrestrial Dust

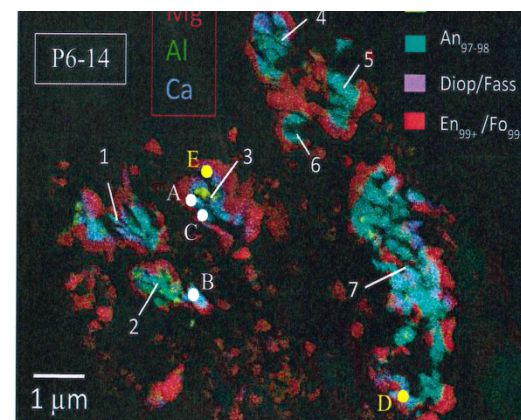
A series of presentations at the Lunar & Planetary Science Conference described investigations of a 50-micron interplanetary dust particle cluster. Grains from this IDP reveal new details about the earliest period in solar system history:

- Irradiation by intense solar flares in the early solar system
- Significant heterogeneity in oxidation state in the solar nebula
- Incorporation of interstellar material from a red giant star

The collection of cluster IDPs, coupled with advanced nanoscale instruments, enabled this new opportunity for consortium study of a single particle that preserves a record of early solar system processes.



Optical image



Mg (red), Al (green),
Ca (blue) image

S. Messenger et al. (2015) Presolar Materials in a Giant Cluster IDP of Probable Cometary Origin, *LPSC 46*.

R. O. Pepin et al. (2015) . Radiation History of Giant Cluster Particle U2-20GCA, A Probable Cometary IDP. *LPSC 46*.

A. Westphal et al. (2015) Metal Content of a Giant Cluster Interplanetary Dust Particle, *LPSC 46*.

Joswick et al. (2015) Variable Titanium Oxidation States in Fassaite in Refractory Nodules from an IDP of Probable Cometary Origin, *LPSC 46*.